

Synopses

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Resin Infiltration

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Background

Traditional, non-invasive treatment of the early enamel non-cavitated carious lesion in the form of remineralisation is a process that requires a relatively long, repeated course of application of remineralisation agents, and requiring high patient compliance.¹ In attempts to overcome these shortcomings and provide for a less time-consuming, patient dependent solution, the concept of pit and fissure sealing was introduced; the aim being to isolate the tooth surface from the biofilm and nutrient-supplying oral environment, thereby halting the carious process.² For occlusal non-cavitated carious lesions, resin-based sealants have been shown to be efficacious in reducing carious lesion progression.^{3,4} Meanwhile, progression of proximal lesions was shown to be significantly reduced following the application of commercially available resin adhesive after etching with phosphoric acid gel.⁵

This ability of resins to penetrate into the porous enamel carious lesion body was first described some 30 years ago.⁶ Since then, the penetration and arrest of artificial subsurface lesions of enamel using dental adhesives and fissure sealants have been extensively investigated in laboratory studies.⁷⁻¹² Unfortunately, the physical characteristics of dental sealants and adhesives are not optimized for high penetrability and therefore only superficial penetration into natural enamel lesions has been demonstrated.¹³ In addition, application of resin or adhesives has been found to be rather difficult to accomplish in the proximal space, regardless of tooth separation, and the presence of excessive material at the sealant margins could serve as unwanted retention sites for plaque and new predilection sites

for carious lesions, as well as potential periodontal irritants. Following this, low viscosity resins, so called resin infiltrant, optimized for rapid capillary penetration, were developed.¹⁴ These materials allow a simple, fast, effective, and minimally-invasive technique to treat early enamel carious lesions.¹⁵⁻¹⁸

The carious lesion infiltration technique was first developed in Berlin, Germany and following extensive *in vitro* validation, DMG Hamburg, Germany developed the product commercially for clinical use. The infiltration technique comprises erosion of the pseudo intact and relatively impermeable surface layer with hydrochloric acid (HCl; pH 0) gel, desiccation of the lesion with ethanol, and subsequent application of an infiltrant twice. The aim was to fill the inter-crystalline spaces of the subsurface lesion (up to a 450 µm depth) with low viscosity, high-penetration coefficient resin, to arrest lesions by blocking interrod diffusion channels.^{13,19,20} In contrast to the application of sealants, where the diffusion barrier remains on the enamel surface as a covering surface barrier, the resin infiltration creates a diffusion barrier within the enamel lesion thereby enabling the strengthening of the demineralized structure with resin matrix, limiting cavity formation.^{13,19,20}

Since its introduction, resin infiltration has been reported to reduce lesion progression significantly in a demineralizing environment in *in vitro*,^{15,16,20} *in situ*,²¹ and in *vivo* studies.^{18,22} *In vitro* evidence of the enhanced penetration of infiltrant has been corroborated *in situ*,²¹ and short-term clinical trials^{18,23} which have all demonstrated the effectiveness of resin infiltrant in preventing further

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The ACFF is pleased to be able to offer a number of grants to help fund selected community projects. Over a period of five years, ACFF is offering a total of \$50,000 per year to fund projects that will have positive impacts on dental caries experience in communities. These grants are proudly supported by Colgate.

THE GRANTS

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HOW TO APPLY

To apply for funding, applicants must complete an application form. These can be obtained by emailing susan_cartwright@colpal.com. Applications will open on 1st October each year and will remain open for four weeks, closing 1st November.

ASSESSMENT AND JUDGING CRITERIA

The following criteria will be employed to assess project suitability:

- Applicants and proposed projects meet the eligibility criteria
- A comprehensive budget projection is made
- Clear and appropriate aims and objectives are articulated
- Clear and appropriate methodology is set out
- A realistic timeline is in place
- An effective method for evaluation of the project is explained
- Capacity for sustainability is demonstrated
- The significance of the project is high
- Levels of evidence to support the approach are provided
- Expected results of the project are outlined
- Project applicants have appropriate experience and qualifications



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demineralization under cariogenic conditions. A recently carried out randomised, split-mouth, placebo-controlled clinical trial showed that after 18 months, 10 of 186 lesions that were infiltrated showed radiographic signs of lesion progression, whereas 58 of the 186 control lesions showed evidence of progression radiographically, thereby arriving at a relative risk reduction of 83%.²⁴ Similarly, another clinical trial on resin infiltration showed significant reduction in carious lesion development in infiltrated lesions with only 7% showing lesion progression compared to the more classical approach of fluoride treatment with 37% showing lesion progression, after 18 months follow-up period.¹⁸

Mechanism of action

Resin infiltrant has low viscosity, high surface tension, and low contact angle with enamel.¹⁹ These properties are important to facilitate penetration of the resin into the lesion body of the enamel carious lesion. Of equal importance is the erosion of the surface layer that would otherwise impede penetration of resin into the lesion body, this being the aim of the conditioning procedure.^{25,26} Meanwhile, the purpose of ethanol application is to desiccate the lesion; to remove the water in the microporosities of the lesion body to ultimately allow the hydrophobic resin to penetrate.²⁷

Morphological studies using confocal laser microscopy (CLSM) and transverse microradiography (TMR) have shown that infiltration of the body of the carious lesion is driven by capillary forces, and is therefore dependent on the morphological characteristics; the pore size and volume of the lesion.^{14,28} The theory proposed by these authors is that the pores within the body of the lesion are functioning as pathways not only for acids and dissolved mineral, but also for low viscosity resin. Therefore, initial carious lesions could be completely infiltrated with resin and these resins would be competing for the space of bacterial colonization and ionic diffusion.^{14,28} In reality, however, the three-dimensional nature of demineralisation and the simultaneous ongoing remineralisation process are characterized by heterogeneous pore distribution, with remineralisation often occurring on areas closer to the surface.²⁹ As this clearly presents difficulty in relation to proper diffusion and penetration of resin into the body of lesion, it is proposed that acid etching to allow for removal of the surface layer prior to infiltration is necessary.^{16,25,28}

This process of acidic etching eliminates the superficial 30 - 40 µm deep enamel layer and allows for more complete penetration of the lesion body.^{16,30}

Some authors have argued that the removal of the surface layer may additionally weaken the lesion structure. Studies into surface layer erosion with 15% HCl gel with application time up to 120 s showed no evidence of cavitation, even after surface layer was completely eroded.²⁵ Moreover, in practice, the subsequent resin infiltration should ensure re-strengthening of the lesion structure.²⁵

Researchers have also reported a high correlation between the penetration coefficient (PC) of resin infiltrant and the penetration depths albeit only shown in artificial and natural lesions *in vitro*.^{16,28} The significance of the penetration depth is that it has been shown to be strongly correlated with the ability of the resin infiltrant material to hamper lesion progression *in vitro*.¹⁵ Data gleaned from research looking into resin with different PCs and their efficacy in lesion penetration using TMR show that resin with PC > 200 cm/s were capable of inhibiting lesion progression.¹⁶ In line with this, resin materials with high TEGDMA concentrations are said to show better inhibition of carious lesion progression than those with high concentrations of BisGMA due to the better penetration capabilities of TEGDMA-based resin.^{15,31}

However, the shortfall of increasing the concentration of TEGDMA is a compromise in the mechanical properties of the final cured resin,³² including higher polymerization shrinkage,³² brittleness,³³ and the promotion of enzymatic hydrolysis.³⁴ In light of this, more recently, resin infiltrants combined with microfillers (42 - 83 µm) have been introduced.³⁵ By applying micro-filled resin infiltrant on a lesion, resin is allowed to penetrate into the lesion body driven by capillary forces, while the filler remains embedded within the resin matrix, thereby offering superior mechanical strength compared to the conventional resin infiltrant.³⁶ Studies on this new material remain at a preliminary phase and have only been studied *in vitro* in artificial carious lesions.³⁶ It is noteworthy that findings of laboratory studies on artificial carious lesions cannot necessarily be accurately extrapolated to natural carious lesions. This is because the pores of natural carious lesions might contain with organic materials, such as protein and carbohydrates that might, in turn, hamper resin penetration.¹⁹

Whilst the concept of enamel infiltration offers a real way forward in minimal intervention dentistry and the concurrent departure from invasive restorative treatments, it is not without issues. Whilst it has been reported that resin infiltration can result in significant reduction in carious lesion progression under demineralising conditions, some degree of demineralisation can still occur following treatment.^{37,38} This could be a result of the partial dissolution of the remaining mineral in the lesion body that was not completely embedded within the resin matrix, or caused by resin shrinkage during light curing ultimately resulting in leakage and reduction of acid resistance.³⁹ Another disadvantage of resin infiltration is that it is likely to hamper future remineralisation attempts. Resin infiltration results in occlusion of the pores of hypomineralised enamel and prevents diffusion of ions into and out of enamel thereby impeding significant remineralisation.⁴⁰

An ideal infiltration material would therefore have the following characteristics: (1) hydrophilic when applied, and hydrophobic after polymerization, (2) possess bactericidal or bacteriostatic properties, (3) biocompatible and well tolerated by the dentinal-pulp complex, (4) offer mechanical support, (5) fully occlude lesion pores, (6) achieve cosmetically acceptable results, (7) be less technique-sensitive with ease of application, and (8) be cost-effective.⁴¹ Further research for a future solution of these challenges will undoubtedly herald a new era of restorative dentistry. Until then, treatment is likely to be limited to rather accessible and relatively superficial lesions in a low-demineralising environment.^{21,41}

Resin infiltration in masking white spot lesions

In addition to the action of resin infiltration controlling carious lesion progression, an incidental finding was to produce a positive effect in masking the opaque colour of demineralized enamel, when resin infiltrant was used on white spot lesions (WSL).²⁰

Enamel demineralization manifesting clinically as a WSL, is a process where enamel dissolution takes place and creates pores between the enamel rods. In early carious lesion formation, the equilibrium between demineralisation and remineralisation is disturbed, resulting in net loss of mineral from enamel.⁴² As the subsurface layer

becomes partially porous, it turns opaque and the lesion assumes a chalky, white appearance.⁴³ Simultaneously, this leads to the alteration of the refractive index in the demineralised area, resulting in the loss of surface shine and alteration in the internal reflection ultimately resulting in greater visual enamel opacity.⁴⁴ Sound enamel has a refractive index (RI) of 1.62. As enamel becomes porous when demineralised, when these pores are filled with water (RI = 1.33), the lesions will appear whitish opaque compared to surrounding sound enamel. When dried, the water in the pores is replaced with air (RI = 1.0), thereby making the lesion more visually apparent. The greater the difference in RI between that of the demineralised lesion and sound enamel, the more apparent the opacity. This is owing to the greater difference in light scattering and adsorption properties of the surfaces,⁴⁵ where a greater light scattering results in increased visual colour differences of enamel.⁴⁶

As a primary strategy to arrest the progress of demineralisation, remineralisation approaches in the form of periodical professional fluoride application represent the frontline of treatment of WSL.⁴⁷ If successful, the intensive remineralisation process should tip the equilibrium favouring remineralisation, resulting in reprecipitation of minerals within the subsurface demineralized zone.^{42,48} Evidence of remineralisation taking place is characterised clinically by the recovery of hardness and translucence, and clinical regression of the WSL to a certain extent.^{43,49} Unfortunately, the remineralisation process may take a long time due to ionic diffusion limitations, and on occasions, the surface of the lesion gains mineral while the subsurface, body of lesion remains porous and thus, complete translucency is not always recovered and the unaesthetic white opacity often persists.⁵⁰ Moreover, exogenous stains may become incorporated into the lesion resulting in formation of brown spots, further contributing to the aesthetic concern.⁵¹

Resin infiltration, therefore, presents an attractive alternative to improving aesthetics of WSL in a more predictable and timely manner. Under the same refractive index concept, when the microporosities are filled with infiltrant resin, the RI increases to 1.52, the difference in refractive index between the infiltrated lesion and sound enamel (RI=1.62) becomes negligible, therefore making the lesions appear similar to the surrounding

enamel.⁵² Following this initial discovery of masking effects of resin infiltrant on WSL, a multitude of *in vitro* and *in vivo* studies have since been conducted, investigating the efficacy of resin infiltrant in improving the aesthetic appearance of WSL.⁵²⁻⁵⁵ With the measurement of aesthetic changes in the form of visual changes utilising Vita® classical shade guide, spectrophotometer, and image analysis software, authors conclusively agree that resin infiltrant has been proven effective in masking WSL.⁵²⁻⁵⁶ A case series of 20 patients with WSL infiltrated with low viscosity resin showed sustained improvement in aesthetics of WSL over a period of 19 months, while also reporting high patient satisfaction, and minimal tooth substance loss due to erosion, although the researchers failed to elaborate on how tooth substance loss was quantified.³⁰

Importantly, some *in vitro* studies investigating the masking effects of WSL using resin infiltrant use artificial subsurface lesions in bovine teeth. Artificial lesions may not be an accurate representation of natural teeth as bovine lesions are of shallower depths thereby the reported results of infiltration may be less reliable.⁵⁵ Resin infiltration treatment protocols developed for artificial carious lesions, when used on natural caries may not necessarily yield similar results. This discrepancy owes largely to differences in enamel and lesion structure, in particular with regard to the surface layer. In the oral cavity, alternating cycles of de- and remineralisation inevitably results in heterogeneous surface layers of the natural lesions, which are likely to show higher mineral content compared to artificial lesions.²⁵

That said, the masking effect of resin infiltrant does not depend exclusively on the infiltrant alone, but is also influenced by clinical factors such as lesion and infiltration depth, lesion activity, complete or incomplete infiltration, polymerization shrinkage as well as the resin colour.⁴⁶ Worth noting also is that resin-based materials present an oxygen-inhibited superficial layer, which could increase susceptibility to surface staining due to incomplete polymerisation.³⁸ While staining behaviour of resin infiltrant has yet to be fully elucidated, it is recommended that polishing following infiltration facilitates the reduction and prevention of subsequent surface staining.^{46,56,57}

Questions, however, remain concerning the aging of the infiltrant over time.

While some authors try to reconcile this by insisting that the TEGDMA resin is hydrophobic in nature and therefore, will have little impact from hydric stresses, the reality is that no long-term follow up studies have been published, with current literature only having a follow-up period of up to 19 months.^{30,56} In short, there have been no published data on the long-term surface hardness or the colour stability of resin infiltrated lesions. Furthermore, some researchers argue that the etching step may interfere with the surface colour as the process of etching removes minerals from the enamel.⁵⁶ However, the immediate application of resin should, in theory, result in reversal of this colour alteration created by the etching process.³⁸

Conclusively, before more concrete recommendations can be made regarding aesthetic treatment using resin infiltrant, further clinical trials with larger sample sizes and longer observation periods are required regarding its clinical performance and stability.

Resin infiltration and developmental defects of enamel

There is currently a paucity in the literature in regards to the use of resin infiltrant in the treatment of developmental hypomineralised enamel defects to improve aesthetic appearance.^{56,58,59} Of the few published, a study investigating the masking effects of resin infiltrant on developmental defects of enamel (DDE) lesions, in particular hypomineralised lesions, observed that 12 out of the 20 teeth tested showed a positive masking effect.²⁶ It should be noted, however, that this study defined hypomineralised lesions loosely, identified visually as an abnormality in the translucency of enamel and also denominated as opacity in the enamel.²⁶ Positively, aesthetic improvement was still observed in teeth with incomplete masking of hypomineralised defect.^{26,60}

A series of case reports pertaining to the treatment of opacities associated with fluorosis and traumatic sequelae have also been published.^{30,56,58,59} These lesions show irregular mineralisation patterns and are histologically characterised by porous hypomineralised subsurface enamel.^{61,62} Hence, the assumption is that by permeating the surface layer, this will enable access to the porous enamel to be penetrated by resin. The resin, with a RI similar to that of sound enamel would then allow for masking of the subsurface lesion.^{30,58,59}

Where unaesthetic molar incisor hypomineralisation (MIH) lesions are concerned, although WSL and MIH both represent hypomineralised enamel conditions, MIH is a developmental rather than an acquired condition and the different innate capacity of tissue to uptake minerals has been reported.^{63,64} The relatively hypermineralised surface layer of a carious lesion, that requires removal prior to resin penetration, may also have different properties to that of the MIH surface.⁶⁵ While resin infiltration is capable of penetrating developmentally hypomineralised enamel, the pattern of penetration has been shown to be inconsistent.⁶⁵ Unlike in carious lesions, the pattern of infiltration in MIH lesions is not easily explained by mineral content or porosity variation. Putatively, the higher protein content may have a role to play in the inconsistent manner of resin infiltration penetration into hypomineralised lesions. In addition, it is possible that the standard etching protocol recommended by resin infiltrant manufacturers are only efficacious at denaturing surface proteins only, with retained, subsurface proteins occluding access to the deeper lesion. This, coupled with the increased surface layer thickness of hypomineralised lesion (18.5–145.5μm) could result in incomplete etching erosion depths and consequently failure of resin penetration into the body of the hypomineralised lesion.⁴⁰ But perhaps the biggest challenge would be to achieve changes through the full enamel thickness and altering the surface layer in order to improve diffusion without concurrently sacrificing the already weakened hypomineralised enamel.⁶⁶

Having said that, the idea of occluding microporosities in defective enamel to potentially improve mechanical properties of enamel remains an attractive one, worthy of further exploration.⁶⁵ Indeed, improvement in mechanical properties may be capable of decreasing the prevalence of post-eruptive breakdown (PEB), as well as improving bonding of adhesive restorative materials.^{65,67} The latter is thought to be a result of the action of resin infiltrant in increasing the surface hydrophobicity, perhaps compensating for inherently poor etching patterns.⁶⁵ Promisingly, a study using demineralized bovine enamel found that pre-treatment with infiltrant resin significantly increased the shear bond strength of flowable composite material.⁶⁵ Crombie et al also showed that when resin infiltrated MIH lesions, although in an erratic and inconsistent manner, it

resulted in increased Vickers hardness values.⁶⁵ However, it must be highlighted that when resin infiltration was used to pre-treat extracted hypomineralised molar teeth, researchers in a separate study found that this form of pre-treatment resulted in lower microshear bond strength compared to ‘routine’ bonding to hypomineralised enamel, where the pre-treatment step was omitted.⁶⁸

In addition, it could be hypothesised that occlusion of the increased enamel porosities and coverage of dentinal tubule orifices with low viscosity resin may contribute to a decrease in pulpal inflammation and sensitivity that have become synonymous with MIH lesions. However, until further comprehensive long-term studies are done, results from limited studies of resin infiltration into hypomineralised enamel and the reported benefits remain speculative at best. Therefore, further morphology-based research, using a larger number of different types of DDE lesions, will undoubtedly provide with better insight and understanding into the treatment of these lesions with resin infiltrant.

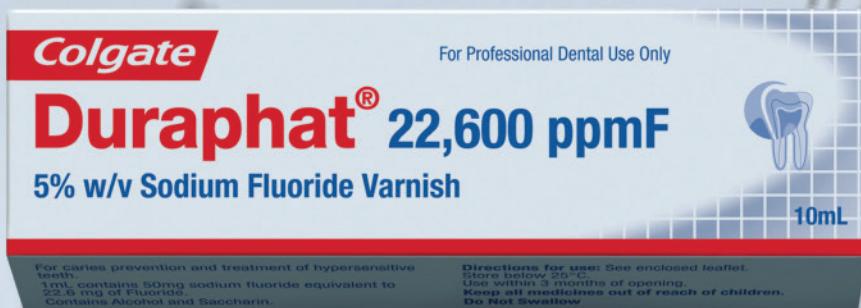
Conclusion

Resin infiltrant was initially developed to treat early enamel carious lesions. Its use has since been expanded to improving the optical properties of enamel WSL. Although resin infiltrants have been shown to be a feasible option in masking WSL, at present, there is no strong evidence supporting the clinical recommendation of the technique. Similarly, resin infiltration of MIH-affected teeth cannot be recommended as a clinical procedure. Conclusively, before this technique can be recommended for use in improving aesthetics of WSL and demarcated hypomineralised enamel lesions, clinical trials with larger sample size, longer observation periods, and development of specific protocols for MIH lesions are needed to validate the clinical performance of resin infiltrants.

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Federal President's Report

Tim Johnston

I am writing this about half way across the north Pacific Ocean on the way home from watching my youngest Son's School Pipe and Drum Band having been part of the Royal Military Tattoo in Nova Scotia.

For all of us who see children as part of our daily work, it is a wonderful experience to be shown just what these young people are capable of. If the dedication, hard work and pride that I have witnessed over the past two weeks can fill the majority of our children, then the world will be OK.

I had the pleasure of being invited to attend the American Academy of Pediatric Dentistry 17th Annual Session in Washington DC in May this year as federal President of ANZSPD. Being an international member of the American Academy of Pediatric Dentistry (AmAPD), I was tossing up whether to attend this meeting, I usually do biennially and I had attended last year in San Antonio. On receipt of the invitation from the now Immediate Past President Dr Jade Miller, the decision was made easy, the only hesitation was time away and the 32 hours of travel time from Perth and the same home. Unfortunately due to the latter, I did not make it to some of the Pre-Congress programs or the President's Welcome Reception which was a pity, but I had the opportunity to meet the President a few times during the conference, extending a warm thanks for AmAPD's invitation and the acknowledgement of the relationship Australian and New Zealand Society of Paediatric Dentistry and the AmAPD have built of many years. I feel it is important that we return the recognition and in doing so will be extending an invitation to the new President Dr Jim Nickman to attend the ANZSPD Biennial meeting on the Gold Coast in February 2018.

The Scientific meeting was very interesting, obviously North American centric but an interesting insight into how North American paediatric dentistry is progressing and changing. To me three things stood out. Last year in San Antonio there was a few presentation where the use of silver diamine fluoride (AgDF) was

mentioned and acknowledged as having potential to assist with caries stabilisation, something we down under are very familiar with. There was also an afternoon dedicated to contemporary dentistry which illuminated the North American wariness of the minimal preparation stainless steel crown ('Hall' Crown). In fact one of the 'eminent' panel members stated they felt there was really no place for that type of treatment in paediatric dentistry, which some in the audience including me, felt was short sighted and possibly very poorly informed, especially in regard to the indication for a 'Hall' crown. Twelve months later, the scientific program contained a number of full presentations on the benefits including protocols to utilise AgDF, not only as a stabilizing agent but as a definitive treatment. One lecture detailed the treatment of all lesions including cavitated interproximal lesions with AgDF with no removal of caries and no restoration of anatomical form, other than to avoid significant food packing. This change was immense in one year but appeared to be well accepted by the delegates. Interestingly in the United States, the FDA continues to list AgDF as a desensitizing agent as it currently is in Australia, rather than a caries active medicament, however this is expected to be changed by the next AmAPD meeting. I know in Australia there is an increase in the use of AgDF to assist with the treatment of caries and it will be interesting to see how this medicament is used in dental communities in the next few years. Where a restoration was required, protocols suggested was simply sealing the area with GIC (not new to AUS and NZ folk) and strong recommendation to place a 'Hall' crown. 12 months, 180 degrees!

The other area of clinical management that appears to have changed in twelve months is elective frenotomy in neonates to assist with nursing challenges. This is a significant part of my practice so the shift

was of great interest to me and appears to be getting a lot of interest in the dental (e.g., ADA News Bulletin July 2017 No. 466), medical and para-medical fields and certainly on social media. In 2016, the AmAPD scientific program had one 45 minute presentation by a New York based paediatric Otorhinolaryngologist who presented intelligently on the subject. Although I did not agree with choice of instrumentation, the lecture detailed succinctly the very narrow indication for frenotomy. Twelve months later the scientific program dedicated in total a day and a half of lectures on neonate frenotomy. Unfortunately I was not able to attend all the lectures but those I was able to listen to again showed positive success with the treatment where indicated, based on correct observation and diagnosis. I hope this increase in correct awareness and evidence based treatment that is obviously growing across North America that is being supported by sound research, will permeate through Australia and New Zealand so less focus is spent on the rubbish information out there and more on assisting these babies and their families correctly. One needs to remember, many of the signs and symptoms of a neonate struggling to nurse efficiently are exactly the same risk factors that we recognise as putting a baby at risk of nursing associated ECC.

Unfortunately there was no time to visit 1600 Pennsylvania Avenue to offer and advise from down under but I am pretty sure the current tenant can create enough trouble on their own.

The hardest part of a break from the practice is facing the return, a full in-tray, a gazillion emails of which ten percent are important but you need to go through them all to see what's what, and the realism of needing to face the jobs you put off until you 'got back'.

The elephant in the room at present is the



up coming Senate enquiry into the Private Health Insurance Industry, we have all been contacted by the ADA to submit thoughts and concerns through the ADA or straight to the Senate Committee. The ADA has prepared a submission document that is comprehensive and easy for someone wanting to detail concerns of in fact satisfaction. ANZSPD has prepared a statement submitted to the ADA for consideration as part of the Dental Associations submission and I thank those who I asked for their comment and thoughts. Clearly the bigger issue affecting the general membership was the inequity seen with the affiliated and preferred provider schemes. Whilst

it is acknowledge that these schemes do in some instances offer favorable mutual benefit to a practice and their clients, overall the feeling is one of inequity. For our specialist members and not limited to, the increasing challenge of access to hospital facilities to provide high quality dental care for children and special needs adults remains a great concern. Without doubt, there is inequity on the ability to access and book theatre time for dental procedures due to PHI contracts favoring medical procedures. Some contractual requirements are plainly illogical, in the end attracting higher funding from the PHI companies and yet, they remain with reducing benefit for dental clients.

For those who do have concerns or real issues with the PHI and how it affects your practice, then I urge you to submit to the enquiry and the ADA portal is a sensible tool to use.

Winter is here but all to soon the end of the year will come. I would like to remind all to diarise the IAPD meeting in Chile 4-7th of October and the ANZSPD Biennial meeting at Seaorld Gold Coats on the 15th to 18th of February with Professor Nicola Innes as our Keynote speaker.

Until we all meet again, stay well, stay safe and have fun.

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Western Australia Branch Report

*Vanessa William
President ANZSPD (WA Branch)*

ANZSPD (WA Branch) is preparing to welcome Professor Lars Andersson to Perth for our Scientific Meeting, 'Managing the Complications Following Traumatic Dental Injuries' on the 15th September. We also have a number of local specialists contributing to the day's program. Please see the advertisement to register for the event.

We would like to congratulate Dr Chaturi Neboda who recently completed her Doctor of Clinical Dentistry in Paediatric Dentistry at the University of Western Australia Dental School. Dr Neboda is now working in private practice and at Princess Margaret Hospital.

Both the graduate (DMD) and postgraduate (DClinDent) Paediatric Programs have done extremely well under the guidance of Associate Professor Robert Anthonappa. The Australian and New Zealand Division (WA Branch) IADR Travel Grant Winners for 2017 were announced in July. Six of the twelve Travel Awards were won by students supervised by Associate Professor Anthonappa. We would like to congratulate DMD students: Eleanor Kim & Yu-Meng Choog; Joon Soo Park; and Jason Cheong & Sara Chiam; and congratulate DCD students: Dr Chat Neboda; Jilen Patel; and Lisa Bowdin. These students will be travelling to Adelaide later this year to present their research. All five postgraduate students, Drs Chaturi Neboda, Jilen Patel, Lisa Bowdin, Nandika Manchanda and Gregory Celine will also be giving oral presentations at IAPD in Chile in October.

The ANZSPD (WA Branch) committee is now busy creating a wonderful program for the RK Hall Lecture series to be held in Perth 2019.

For any questions regarding our Scientific Meeting in September, please do not hesitate to contact our ANZSPD WA Branch Secretary, Dr Rebecca Williams at anzspdwa@gmail.com

New Zealand Branch Report

Kate Naysmith

Tenā koutou,

The ANZSPD New Zealand Branch has had a very busy start to the year with hosting the RK Hall lecture series, The Art and Science of Paediatric Dentistry, in Auckland on the 26-27th March. It was a very successful meeting with around 120 delegates attending. The scientific programme had a great range of topics with some very interesting and thought provoking presentations from local medical and dental specialists. The keynote speaker, Dr Ari Kupietzky, from Jerusalem, Israel, was a very engaging speaker with excellent presentations on the art and science of restorative dental treatment for young children. A wonderful conference dinner was held at the beautiful Cable Bay winery on Waiheke Island and it was a great chance to catch up with old friends and make some new ones. Many thanks must go to Drs Craig Waterhouse and Alison Meldrum, plus the NZ Branch committee for their hard work in organizing this fabulous lecture series.

The branch has also been active in making a submission in support of the amendment to the water fluoridation bill. This amendment, if successful, will change the decision on whether the local government drinking water supplies are fluoridated or not from the local authorities to the District Health Boards.

We are soon to have a much treasured member, teacher and mentor to many of us, Prof Bernadette Drummond, leave our shores. We wish her success in her move and new role at Leeds University.

The next event on our calendar is our annual study day that is being held in Wellington on Saturday 18th November 2017. This is a wonderful day where our members' come together and listen to some organized speakers but can also present cases or topics if they choose in a very supportive environment. I am looking forward to seeing lots of NZ Branch members there.

Ngā mihi.



The ANZSPD Alistair Devlin Memorial Grant

At the ANZSPD Federal Council meeting in Melbourne in February 2014, it was decided that the existing ANZSPD Grant be renamed The ANZSPD Alistair Devlin Memorial Grant in honour of Alistair's memory and to acknowledge his most significant contribution to the society.

One grant per year will be provided to the value of AUD \$2000 with eligibility restricted to current Full Members of ANZSPD (Inc.). The grant is available for:

- An oral health initiative in Australia or New Zealand which may be an educational resource or a broad community initiative
- A community research project directly related to child oral health
- Support for an oral health project in Asia, Oceania or the Pacific which might be for materials, instruments, books for a school, etc.

Applications should be submitted electronically to:

Dr Carmel Lloyd, Federal Secretary, ANZSPD (Inc.) • federal.secretary@anzspd.org.au • by 30th October 2017

Federal Council will then adjudicate.

For more information see the Competitions and Awards page at www.anzspd.org.au

The successful applicant will be required to provide a report to the Federal Council, suitable for publication in the society's newsletter, Synopses, by the end of the following year. The Federal Council may choose not to award a grant in the event of there being no suitable applications.

Linking Oral Health and General Health: A Study of Twins

Mihiri Silva

Dental caries is the most common chronic disease in childhood and is associated with a range of adverse outcomes including infection and hospitalisation, at significant cost to the community.

Despite this, and links with non-communicable diseases, the cause of oral disease is incompletely understood. A combination of genetics and environmental factors, starting in the prenatal and early childhood period, are likely to be important. However, a lack of robust evidence in this area is hampering the development of effective preventive approaches.

The Victorian branch of ANZSPD has now joined forces with the NHMRC and ADRF to support a unique study aimed at teasing apart the role of genetics and environment in dental caries and developmental defects of enamel (DDE). The Peri/postnatal Epigenetic Twins Study (PETS) is a cohort of 250 mothers and their twin children was established in 2007. Extensive data regarding nutrition, health, illness and

lifestyle and serum samples were collected throughout pregnancy and from the children at 18 months of age. The most recent phase of the project has recently been completed with participation of 173 of the original 250 twin pairs, now aged 6 years. In addition to collection of various bio-samples, including blood and saliva, the families have completed detailed questionnaires about health and lifestyle and for the first time in the study, participated in comprehensive dental examinations. Dental caries is recorded using the International Caries Detection and Assessment System. Developmental defects of enamel are measured using the modified DDE Index and, as a particular area of interest in the study, Hypomineralised second primary molars are recorded using MIH/HSPM specific criteria. The project is now in

the analysis stage. Firstly, complex twin statistical methods will be employed to determine the genetic and environmental contributions to the aetiology of both caries and HSPM. The study will use the vast data collected from early life to explore the association between various early life risk environmental factors, such as maternal alcohol intake, smoking, vitamin D and these oral diseases. A subset of twins will also be included in a pilot study to explore the differences in salivary microbiome in twins with and without dental caries.

It is hoped that by improving our understanding of the aetiology of dental caries and developmental defects of enamel, this study will inform future preventive and diagnostic interventions to reduce the burden of oral disease in childhood.

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The Australian and New Zealand Society of Paediatric Dentistry WA Branch

Managing the Complications Following Traumatic Dental Injuries

Friday 15 September 2017

8.00am - 5.00pm

(Registration from 7.40am)

The University Club of Western Australia



International Keynote Speaker: Professor Lars Andersson

*Professor Andersson has published extensively in the field of traumatology. He has been textbook editor and chapter author in the fields of both trauma and oral and maxillofacial surgery. He was Editor in Chief of the internationally renowned scientific journal, *Dental Traumatology* from 2007 to 2015 and is the Immediate Past President of the International Association of Dental Traumatology.*

Dr Vanessa William and Dr Mike Razza

Opening address "Falling from the Monkey Bars"

Professor Lars Andersson

Traumatic Oral Injuries - Where are we today?

Dr Sheyda Khadembaschi

Managing complications of dental trauma through interdisciplinary care

Professor Paul Abbott

Short and long term endodontic complications following trauma to the teeth

Professor Lars Andersson

Strategies to avoid and manage complications following anterior tooth losses in young growing patients

Professor Lars Andersson

Soft tissue management and how to avoid complications

Dr Mike Razza and Dr Brent Allan

Autotransplantation - Planning from an Orthodontic and Surgical Perspective

Dr Wendy Gill

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Rotary Australia-Vietnam Dental Health Project

Field Team 2017 Trip Report

Jessica Tam BSc

DDS student, Melbourne Dental School, University of Melbourne

Background

Following two decades of the second Indochina war ending in 1975, Vietnam has undergone rapid economic growth that has transformed the developing country from one of the world's poorest nations into a low-middle income country. However, its health care system remains strained with insufficient resources to cater for its nation of ninety two million people [1].

The burden of oral disease is a major public health issue in Vietnam. A National Oral Health Survey conducted in 1999 found the general oral health status in Vietnam to be poor, characterised by high dental caries experience and prevalence, low oral hygiene levels, and a lack of access to dental care [2]. The child population was particularly affected, with dental caries experience reported to be extremely high. By 15 years of age, 70% of children had caries experience in their permanent dentition, most of it untreated [3]. There is an urgent need to improve access to care and raise the oral health literacy to promote oral health throughout the entire population [2].

Since 1991, the Rotary Australia-Vietnam Dental Health Project (RAVDH) field team has conducted annual visits to rural locations throughout Vietnam, with three aims: 1) To provide primary dental care to children aged approximately 12 years, 2) To promote oral disease prevention through dissemination of oral health information to schoolchildren and their teachers, and 3) To work with local dentists to provide continuing education in areas such as dental techniques, materials, infection control and oral health promotion.

The RAVDH field team returns annually to the same location for approximately three years, facilitating the development of meaningful rapport with the local dental workforce and community that allows the positive impacts of the project to be long lasting and sustainable. This year is the third visit by the field team to a town called Tan Chau.

Experience of the field team

"You won't be needing that jumper again," Dr Jamie Robertson joked as we

boarded the flight from Melbourne to Ho Chi Minh City in early March this year. He was absolutely right. Stepping off the airplane, we were greeted by the tropical warmth and humidity that would become the backdrop of an unforgettable two weeks of volunteer work ahead.

From Ho Chi Minh City, we journeyed by minibus five-hours northwest towards Tan Chau. Unlike the sparse grasslands of rural Australia, Vietnam is densely populated outside its big cities and this made for a very scenic and interesting drive. Tan Chau itself is a small town, situated on the bank of Mekong River and close to the Cambodian border. With a population of 184,000, this charming town has a lively energy, bustling with people but without the overwhelming and crazy traffic of Saigon. I grew very fond of the relaxed and communal outdoor culture of Tan Chau; in the evenings we would join local residents on plastic stools along the sidewalk, enjoying iced tea and chilled beer.

The field team arrived at Tan Chau District Hospital to set up the day before work began. We had brought all the dental instruments, restorative materials and auxiliary items needed to provide restorative dental treatment with us from Australia. This ranged from protective wear, handpieces and matrix bands, to a portable air compressor and dental unit. The comprehensive assortment of equipment we had was but a small testament to the immense amount of masterminding by Dr Robertson in the planning and coordination of this trip.

The usual work of the hospital's dental clinic was on pause during our time there, and we were given use of three dental chairs across two rooms. Setting up the dental units and chairs required some intelligent fiddling and problem solving; but in the end we had three dental chairs functioning adequately enough for use. One handpiece unit was taped to a chair for stability, and another was carefully balanced on a stool. Although water and electricity supply was available, the chairs themselves did not move, nor had suction or light. Treatment was provided with the chairs permanently in

a reclined position, with a bucket on the floor for spitting, and we wore headlights. The clinic was also equipped with an autoclave, a fridge to store GIC material and an amalgamator; with equipment donated in previous years by RAVDH, and GIC donated by GC Corp. Overall, the clinic was well equipped with facilities to provide restorative treatment under the demands of high patient turnover. It took a couple of days to get used to the heat, but in general, the working conditions were comfortable if we remembered to stay hydrated.

This year the field team comprised of three dentists, three dental assistants, two final year dentistry students (Lakkhana Rabel from La Trobe University, and myself) and a local translator. Over the next eight working days, the team worked together to collectively treat over three hundred schoolchildren. A typical day would begin with the first class of students arriving at 7:30am accompanied by their teacher. It would take approximately four hours to provide care for a class of 20-25 students, with a lunch break before seeing a second class of children in the afternoon. In order to manage the patient load, a triaging system was developed to enable efficient and prompt delivery of treatment; clinical operators alternated between dentists and students under supervision to avoid fatigue; one dental assistant was solely responsible for managing instrument sterilisation; and patient changeovers were swift – between patients, bracket tables and handpieces were wiped with alcohol, and setup with a fresh bib, gauze, instruments and burs. In hindsight, the days were long, but that was not noticeable – the working environment was very fast paced and lifted by the enthusiasm of the whole team and visiting children.

Clinical treatment and challenges

Untreated carious lesions were the predominating diagnosis in the schoolchildren. Sadly, we encountered many unrestorable first permanent molars. Often these teeth were so severely broken down that they had openly exposed pulpal tissue proliferating beyond the boundaries of the pulp chamber (chronic hyperplastic pulpitis or pulp



polyp). Others presented with dental abscesses, fistulas and significant intraoral swelling. It was definitely a reality check to learn that these children had never known to seek medical or dental help, and were often completely unaware of their own dental problems. When asked about a history of dental pain, several children in each class would consistently report the affirmative.

The most common type of carious lesion seen was pit and fissure caries of the molars, followed by the premolars, and then anterior maxillary approximal caries. Unfortunately, without x-ray facilities it was difficult to diagnose inconspicuous posterior approximal lesions. Between students, the number of carious lesions varied; a few patients in each class required at least ten restorations, whilst others only needed fissure sealants. Empirically, we noticed the dentition of children from city schools was in far worse condition compared to those from more remote areas. Generally, most children needed restorations at the occlusal and buccal surfaces of mandibular first permanent molars. These observations are consistent with literature reporting the caries experience of Vietnamese schoolchildren.

All salvageable carious teeth were restored and fissure sealants placed on the applicable remaining teeth. The primary filling material used was high viscosity conventional glass ionomer cement (Fuji IX®, GC Corp, Japan). Resin composite was also used when aesthetically indicated. Besides the occasional hiccup (such as a power outage, or running out of our favourite burs), we were able to achieve restorations of an adequate standard by following regular protocols. Extractions were not undertaken because it is already a mainstay treatment in Vietnam, and this allowed us to allocate maximum time to providing preventive and restorative care where it is less accessible.

When placing restorations, we tried to be as conservative and minimally invasive as possible; but without the luxury of radiographs we often faced the clinical dilemma of whether to restore or fissure seal carious lesions. In borderline cases, we opted to be ‘safe’ by adopting the positive assumption that the carious lesion extended into dentine and restored the tooth. At the time, this was clinically justified for the several reasons: no ability to monitor lesions over time, the high caries risk status of most children, and the high rate of caries progression in the newly erupted teeth of our adolescent patients. The outcome was such that sometimes I regretted accessing a fissure, while other times I was very glad that we did.

Another notable clinical challenge was achieving moisture control in children with high saliva flow. Without suction, patients needed to sit up to spit into a bucket, and at times this may have compromised the restoration quality. Fortunately, the chemistry of GIC material is such that bonding to enamel and dentine can still occur on a hydrated tooth surface; but the amount of saliva occasionally present was definitely not ideal.

The language barrier also meant that communication was sometimes limited during treatment. The team had a wonderful translator and several members who could speak Vietnamese; however, the fast pace and sheer volume of work kept everybody busy, subtracting from the capacity to obtain more detailed histories, glean individual risk factors and provide tailored advice regarding oral hygiene and dietary habits to every individual. Our translator, Cuc, ingeniously stuck a very helpful page of translations on the wall in front of every dental chair. By the end of our trip, we had become well versed in a few essential terms to carry us through an appointment: ‘hello, xin chào’, ‘please,

làm ơn’, ‘open, há’, ‘bite, nhai’, ‘finished, xong rồi’ and ‘thank you, cảm ơn’.

All the children we treated were extraordinarily well behaved and receptive to dental treatment. I was amazed by the patience and stoicism exhibited as they endured often lengthy and extensive treatment. Of all the children treated, only a handful required local anaesthesia.

It was heart-warming to experience the sweetness and enthusiasm of the schoolchildren. We had lots of fun with them and there was plenty of chatter, laughter, singing and dancing. For most children, this was their first visit to the dentist so it was important to us that they had a positive experience. We tried to foster a safe and fun environment as much as possible. Despite the fear and discomfort that can often accompany dental visits, the children seemed enthusiastic towards the team and expressed a lot of gratitude for the work. A few lucky team members were even occasionally gifted soft drinks and candy (obviously eaten in a low cariogenic manner!).

Impact and outcomes

The schoolchildren involved this year were a small and discrete subsection of the wider community in Tan Chau and its surrounds. Although the Project was able to deliver preventive and restorative care throughout the two weeks, the reality is such that general access to this type of treatment will continue to be very limited for most people, especially in remote communities. However, it is hoped that through the exposure to dental care, we have boosted their oral health awareness and general critical acceptance towards the dental workforce. Wherever possible, oral hygiene instruction and dietary advice was provided to students and their teachers in a group setting. We hope that by reinforcing oral health messages in such an interactive way, the students and teachers will remember them and



in the future pass it on throughout their communities.

We experienced wonderful hospitality from our hosts at Tan Chau District Hospital and National Hospital of Odontostomatology. They ensured we were always safely transported between each destination and well fed with delicious local Vietnamese food. We had lots of fun exploring Vietnamese cuisine during our time there. We sampled exotic tropical fruits, street food, duck foetus, catfish hotpot and everything in between; but it was traditional coffee with condensed milk that stole the hearts of the field team, providing extra sustenance for this whirlwind trip chock full of intense work and play.

This trip was packed with plenty of activities. In Ho Chi Minh City we braved seas of traffic exploring the city by foot, learned to bargain with market vendors, visited an amusement park and experienced the nightlife of the city. In Tan Chau, we strolled along the Mekong River sampling street food, visited many nearby villages and local workshops, and went to a karaoke night organized by our new friends from Tan Chau District Hospital. On the weekend, we escaped to a resort on the southern coast of Vietnam where we had fun exploring temples and caves, and experienced the blissfulness of barbequed seafood by the beach. Throughout our time in Vietnam, we were repeatedly humbled by the warm welcome we received from the locals. A memorable highlight was one evening when our team, on the hunt for dinner, walked past a wedding and was invited in by the bride and groom. They instantly set up a table for us and we all had a fantastic night of food and dance.

I enjoyed every single moment of this

volunteer trip. It was intense, challenging and so much fun. I am deeply grateful to everyone on the field team for all their support, camaraderie, friendship, laughter, and their generosity in wisdom and knowledge. As a student, this has undoubtedly been the highlight of my course. I am equally grateful to Dr Robertson and Ms Tricia Hogan from GC Corp for this opportunity. It has been very inspiring to witness the hard work and dedication of Dr Robertson and everybody involved to the cause of the RAVDH Project.

PART 2: Region specific caries risk factors

To increase understanding of the specific causes behind the high rate of caries in the children we were treating, various caries determinants were investigated further. Based on experiential evidence, the findings are outlined below.

Access to dental care

Geographical mal-distribution of the dental workforce is a common problem faced by developing countries. While 66% of the population in Vietnam lives rurally, most of the dental workforce is located in urban areas [4]. In Southern Vietnam, the ratio of dentist to population drops considerably from 1:13,400 in urban areas, to 1:178,500 in rural areas [5]. Such inequality of access to dental care leads to large disparities in the oral health of rural populations compared to their urban counterparts.

In Tan Chau and its surrounding regions, access to dental treatment is very limited. There are four resident dentists at the Tan Chau District Hospital who also work privately to support their income. The hospital services communities from the

far surrounds, including patients from Cambodia. Speaking with the hospital dentists, I learned they see between sixty and seventy patients per week, mostly treating dental and facial trauma caused by motorcycle accidents. It was clear that the dental workforce in this region is not only limited, but also preoccupied with emergency treatment; leaving basic restorative and preventive care unavailable to the wider community.

Furthermore, patients are required to pay for treatment, even in a public hospital. This may be a significant cost burden and barrier to treatment, particularly because people living in rural Vietnam tend to come from low-income backgrounds.

Many of the children treated this year came from remote towns. In addition to geographical and financial barriers, primary prevention services generally appeared to be unavailable as the limited dental services tended to focus on emergency treatment. The wider implication of this is persistence of a culture wherein important primary dental care for children is not on the agenda for families, being neither sought after nor readily available. All of these factors limit access to dental care and contribute significantly to the neglected dentition of the many children we treated.

Diet

Diet was perhaps the most significant determinant for the high prevalence of dental caries. With continued economic development of Vietnam over the past few decades, traditional diets have become increasingly westernised, resulting in greater sugar consumption. Schoolchildren demonstrated frequent and regular snacking behaviour, especially on sweets. As they waited for treatment, stashes of candy were pulled out of



bags and pockets to snack on. To stay hydrated in the heat, children carried sweet beverages to sip on throughout the day. Rarely was water seen. When asked about their favourite foods, “lollies” was often the resounding answer.

The traditional Vietnamese cuisine may be further raising the caries risk of these children. Noodles, bread and rice are dietary staples in Vietnam, all of which are high in starch content. Starch alone is not regarded as highly cariogenic, but studies have demonstrated its cariogenic potential when heat-treated during cooking, and broken down into simple sugars such as glucose and maltose by salivary enzymes [6][7]. Traditional Vietnamese food itself often has sweet undertones, even in dishes considered savoury. Vietnamese dishes also commonly involve fish sauce for dipping, which often contains sugar. Therefore, when considered together, starchy main meals coupled with frequent sugar consumption may exaggerate the overall cariogenicity of the diet of a typical Vietnamese student. This is an area that should be researched further.

Oral health literacy and oral hygiene

I was impressed by the oral health literacy of many of these children, however, there seems to be a broad disconnect between their theoretical knowledge and real life practices. During a group interview, children demonstrated awareness that sugar is bad for their teeth and self-reported beliefs that their dentition is important to eating and aesthetics. At the same time, it was apparent that their knowledge did not always reflect in their behaviour, particularly with regards to diet. Their arbitrary understanding that ‘sugar is bad for your teeth’ does not appear to effectively divert these children away from their sweets. Perhaps they lack

understanding of the direct link between lollies and their dental pain/decay; or the habits of high sugar consumption have too much stronghold in these communities. While the exact reasons are uncertain, it is clear that far more than simple dietary instruction is required to break these habits and prompt a shift in school culture to improve the dietary intake of these children.

When quizzed about oral hygiene knowledge, children demonstrated awareness of good oral hygiene habits. There was also high compliance in oral hygiene practices, with children self-reporting to brushing with toothpaste regularly, between one and three times per day. However, when asked about flossing, blank stares were always drawn. These communities had no awareness of interdental cleaning at all. Furthermore, high levels of plaque and calculus observed during treatment indicated ineffective brushing despite its regular frequency. Most children were taught to brush by their mothers. These findings suggest that while the good habit of brushing has been instilled, the importance of its effectiveness is not always conferred.

Good oral hygiene versus poor diet

In examining the oral hygiene and dietary behaviour of children in the Tan Chau region, it became apparent that positive oral hygiene practices were unable to counteract the effects of extremely poor diet. This was crystallized during a visit we made to a primary school in Tan Chau city. Over the years, the RAVDH has supported a school program involving daily school-wide tooth brushing and a weekly fluoride rinse (found to be 5800 ppm). Pupils would congregate in the courtyard to be guided through brushing by a teacher over loudspeaker. Children

were instructed on which surface to brush, continuing until instructed on where to brush next. Every child had a personal toothbrush, sinks were available throughout the school, and children were encouraged to brush their teeth after every meal. There were plenty of reminders to encourage good oral hygiene practices, and it was wonderful to see compliance by many of the students.

However, effectiveness of the school oral hygiene program may be undermined by the massive amounts of candy and colourful beverages the children carried around. Asking them where the candy came from, children pointed to a school shop in the style of a milk bar. This shop stocked an abundance of sweet drinks and candies dangling alluringly from the ceiling and along the shelves. The vendors reported daily takings of around 1 million dong per day (AU\$60), just from sweets. To put this in context, the cheapest candy sold cost 500 dong, which is roughly AU\$0.02. This equates to approximately 6000 small candies sold per day, within a school of approximately 700 students. The caries problem at this school was apparent without having to do a clinical assessment. Smiling children as young as 6 years of age would greet us with incisors blackened with rampant caries. When posing for photos, they would invariably close their lips to hide their teeth, offering a glimpse into the severe social impacts that poor oral health can have on children, even at such a young age.

Fluoride exposure

As an important protective factor against dental caries, we investigated the levels of fluoride exposure for the children we saw. The caries protective benefits of fluoride are achieved via its effects on inhibiting tooth demineralisation,



enhancing remineralisation, and bactericidal properties against bacteria at high concentrations. We tested, with the help of Dr Peiyan Shen and Prof. Eric Reynolds from the Melbourne Dental School, the water soluble (bioavailable) concentrations of fluoride sampled from the main vehicles of its delivery to the schoolchildren*: locally bought toothpastes, the tap water supplies and a fluoride rinse from a school in Tan Chau.

The fluoride testing yielded mixed results. The four toothpastes available in local stores had low bioavailable fluoride concentrations ranging between 19 ppm to 316 ppm. This is far below the recommended minimum of 1000 ppm for children above six years of age, as per the Australian fluoride guidelines [8]. As toothpaste is an important vehicle for the regular delivery of fluoride, these results are particularly troubling. It is possible that the toothpastes tested are counterfeits, as two of the three brands are popular toothpastes in Vietnam (Glister, P/S and Close-up - the latter two are manufactured by Unilever), and both Close-up and Glister advertise their toothpaste as having fluoride concentrations of 1000 ppm.

Fluoride levels in the drinking water in Tan Chau and the schools involved with the project this year were also tested. Water fluoridation is usually a public health initiative that confers universal caries preventive benefits to the communities it reaches. While there is no reticulated water fluoridation in An Giang province, an analysis of the ground water in four separate locations showed naturally occurring fluoride concentrations varies widely: at 1.38 ppm, 2.19 ppm, 2.46 ppm and 3.08 ppm. These concentrations are up to three times higher than the recommended level of 1 ppm in Australia [8], which is considered the optimum level for a reasonable balance

between caries preventive benefits while minimizing the risk of fluorosis. As fluoride concentrations increase beyond 1 ppm, there is a dose dependent increase in fluorosis prevalence and severity [9].

As expected, we encountered cases of mild to moderate fluorosis with white opacities and brown staining. Fortunately, despite the surprisingly high water fluoridation of multiple locations, zero cases of severe dental fluorosis with discrete enamel mottling were seen amongst the children treated, possibly indicating low levels of water consumption. In areas with high water fluoride levels, it is possible that fluorosis played a role in the widespread carious breakdown that patients sometimes presented with, reflecting weakened tooth structure in fluorosis-affected teeth.

The fluoride levels in both toothpaste and water are too variable to fully understand its effects on the dentition of this population, however, it is unlikely that these schoolchildren are receiving any significant caries protective benefit from fluoride exposure, especially in the context of their high caries risk. In observing such high caries experience, it appears that fluoride is not reaching communities in an effective way – the fluoride levels in toothpastes are inadequate, and children drink very little tap water. Moreover, fluoride exposure may actually be potentially damaging in regions with especially high water fluoride concentrations. But having said that, perhaps things could be a lot worse without it. Further investigation into the effects of fluoride exposure in rural Vietnamese communities is warranted.

Summary of caries risk factors

Despite an understanding of good oral hygiene, it is generally not enough to combat the caries problem in this sample of schoolchildren. Cheap and readily accessible sugary food and drinks appear

to negate the positive effects of good oral hygiene practices and fluoride exposure. The situation is worsened by a lack of access to primary preventive dental care, placing children of this population at high risk of widespread and severe caries. These findings highlight the importance of managing all the major risk factors without narrowing focus on just one.

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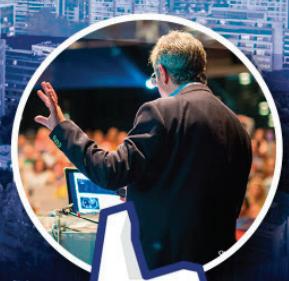
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